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(54) APPARATUS AND METHOD FOR PERFORMING HANDOVER IN WIRELESS COMMUNICATION SYSTEM

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H04W 52/40 (2009.01)
H04W 72/00 (2009.01)

(52) **U.S. Cl.**
CPC ***H04W 36/0055*** (2013.01)

(58) **Field of Classification Search**
CPC . H04W 36/00; H04W 52/40; H04W 72/0413; H04W 72/042; H04W 76/021
USPC 455/436, 450, 451, 452.1, 452.2, 433, 455/3.03
See application file for complete search history.

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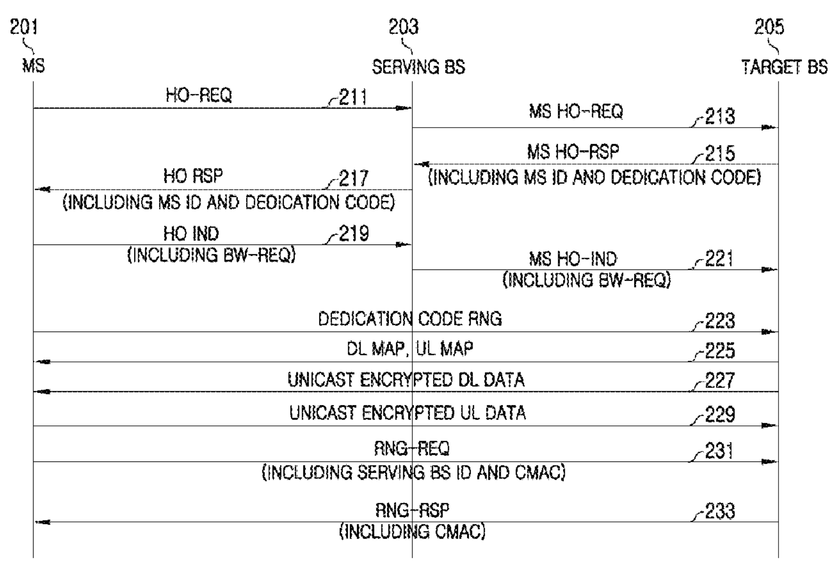
(57) **ABSTRACT**

An apparatus and a method for handover in a wireless communication system are provided. The handover method includes, when handing over to another Base Station (BS) while being serviced by a serving BS, determining whether there exists data to transmit in an uplink, and, when the data to transmit in the uplink exists, requesting bandwidth from the serving BS before commencing a network re-entry to a target BS for the handover.

17 Claims, 4 Drawing Sheets



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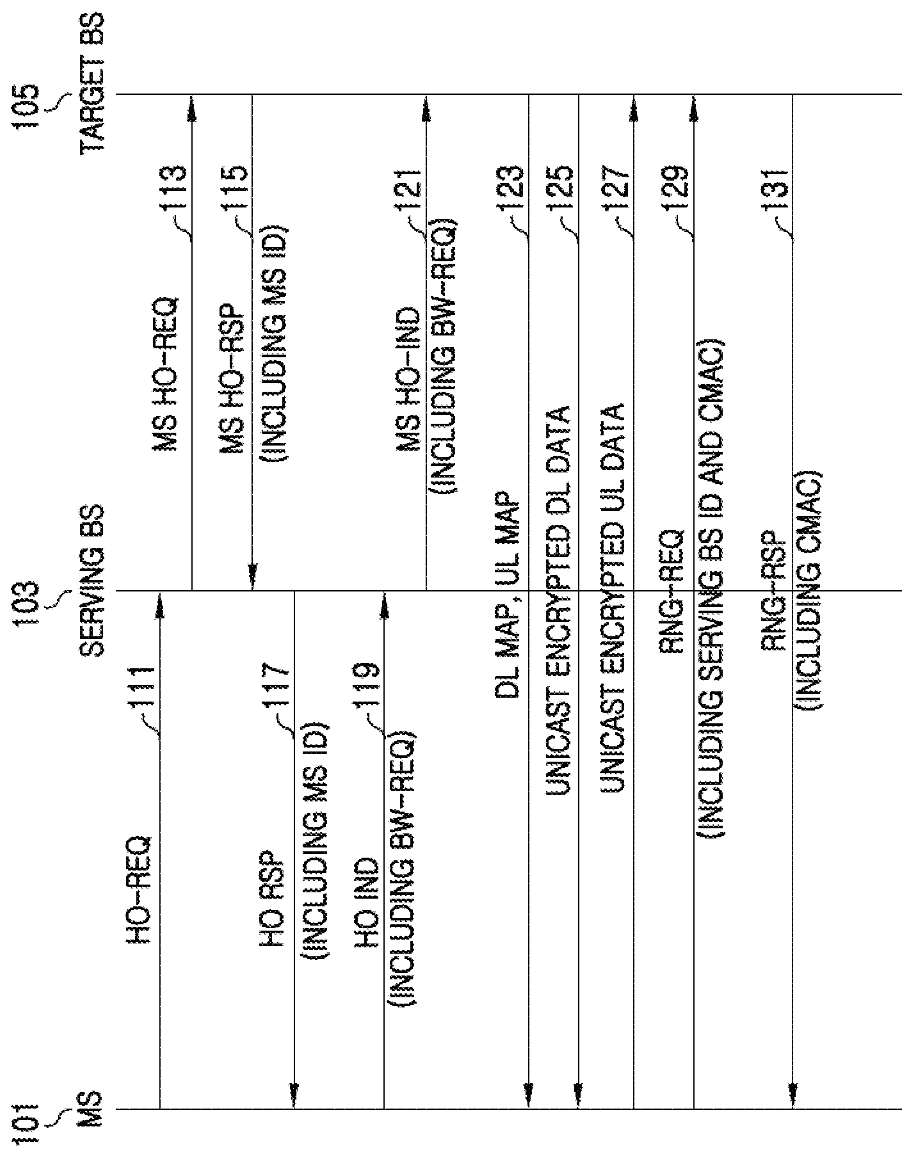

101
MS
103
SERVING BS
105
TARGET BS
HO-REQ
111
MS HO-REQ
113
MS HO-RSP
(INCLUDING MS ID)
115
HO RSP
(INCLUDING MS ID)
117
HO IND
(INCLUDING BW-REQ)
119
MS HO-IND
(INCLUDING BW-REQ)
121
DL MAP, UL MAP
123
UNICAST ENCRYPTED DL DATA
125
UNICAST ENCRYPTED UL DATA
127
RNG-REQ
(INCLUDING SERVING BS ID AND CMAC)
129
RNG-RSP
(INCLUDING CMAC)
131

FIG. 1

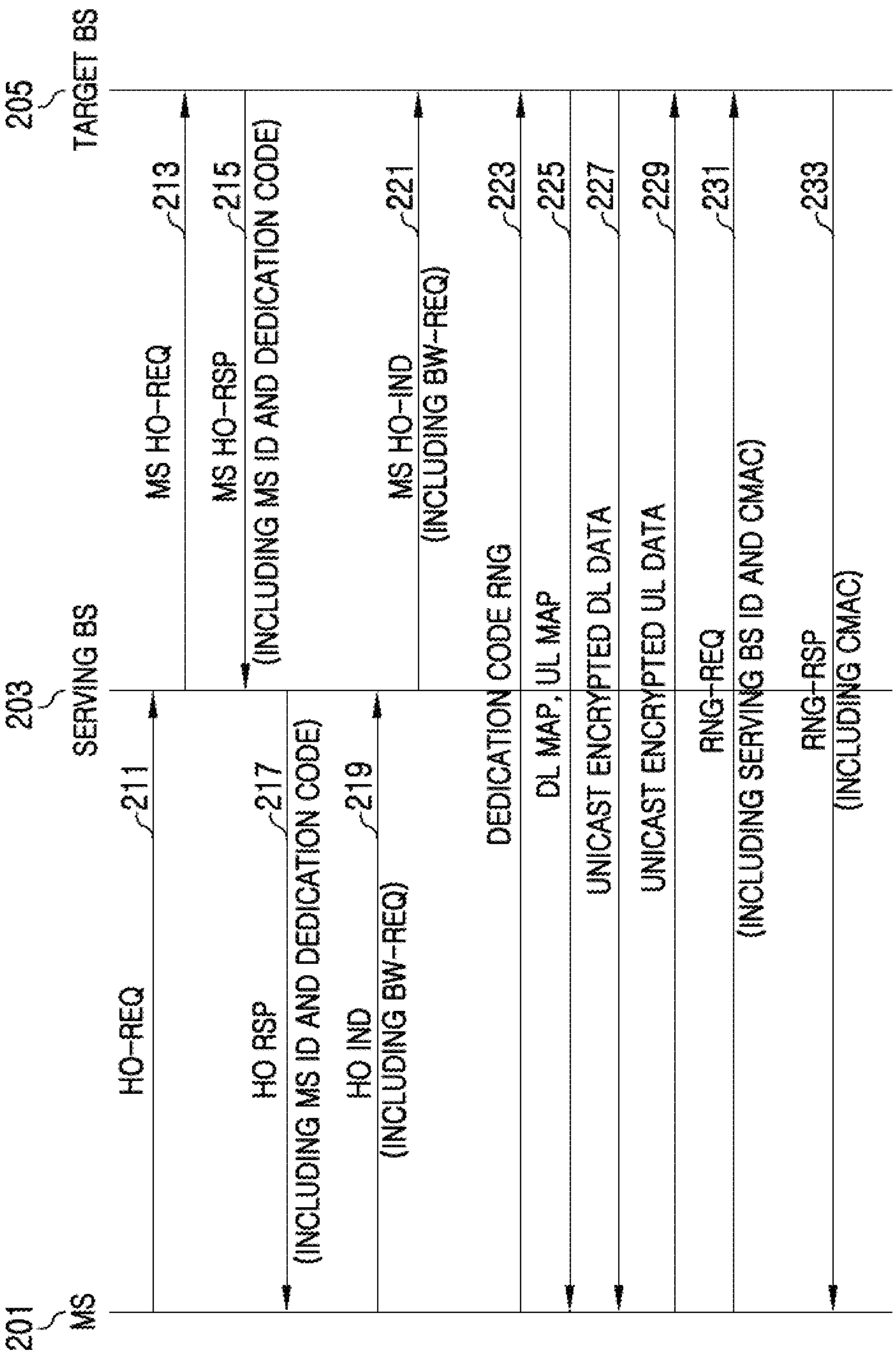
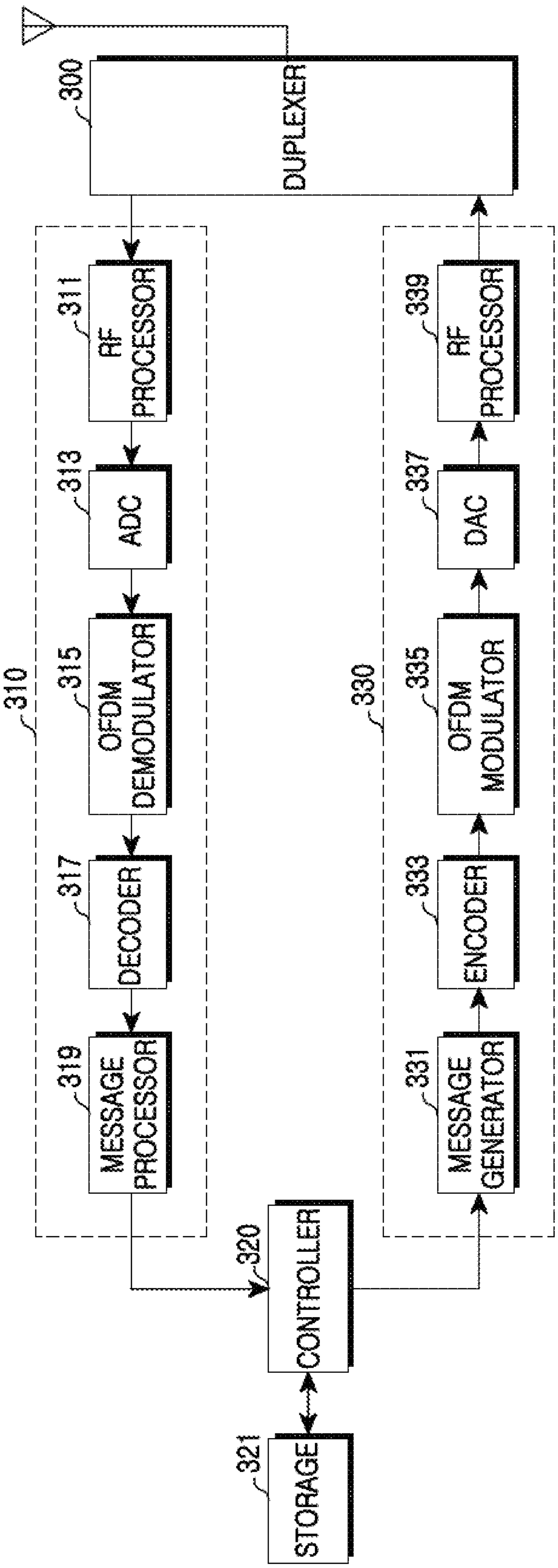

201
MS
203
SERVING BS
205
TARGET BS
HO-REQ
211
MS HO-REQ
213
MS HO-RSP
(INCLUDING MS ID AND DEDICATION CODE)
215
HO RSP
(INCLUDING MS ID AND DEDICATION CODE)
217
HO IND
(INCLUDING BW-REQ)
219
MS HO-IND
(INCLUDING BW-REQ)
221
DEDICATION CODE RNG
223
DL MAP, UL MAP
225
UNICAST ENCRYPTED DL DATA
227
UNICAST ENCRYPTED UL DATA
229
RNG-REQ
(INCLUDING SERVING BS ID AND CMAC)
231
RNG-RSP
(INCLUDING CMAC)
233

FIG. 2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311
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ADC
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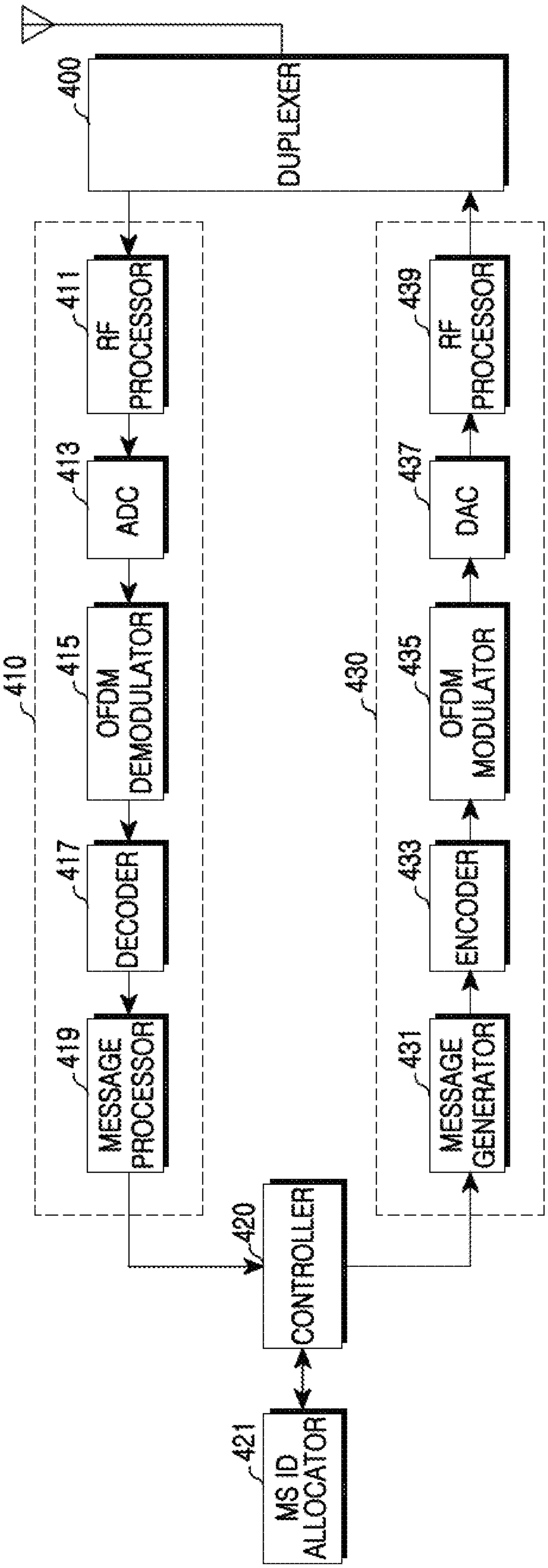
OFDM DEMODULATOR
317
DECODER
319
MESSAGE PROCESSOR
320
CONTROLLER
321
STORAGE
330
331
MESSAGE GENERATOR
333
ENCODER
335
OFDM MODULATOR
337
DAC
339
RF PROCESSOR

FIG.3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DUPLEXER
410
411
RF PROCESSOR
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ADC
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DECODER
419
MESSAGE PROCESSOR
420
CONTROLLER
421
MS ID ALLOCATOR
430
431
MESSAGE GENERATOR
433
ENCODER
435
OFDM MODULATOR
437
DAC
439
RF PROCESSOR

FIG. 4

APPARATUS AND METHOD FOR PERFORMING HANDOVER IN WIRELESS COMMUNICATION SYSTEM

PRIORITY

This application claims the benefit under 35 U.S.C. §119 (a) of a Korean patent application filed in the Korean Intellectual Property Office on Jul. 1, 2008 and assigned Serial No. 10-2008-0063353 and the Korean Intellectual Property Office on Jul. 1, 2009 and assigned Serial No. 10-2009-0059556, the entire disclosure of which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an apparatus and a method for handover in a wireless communication system. More particularly, the present invention relates to an apparatus and a method for reducing a handover delay in the wireless communication system.

2. Description of the Related Art

Rapid growth of the mobile communication market has included demands for various multimedia services in a wireless environment. To respond to these demands, research is being conducted on wireless communication systems for supporting high-speed services to guarantee mobility and Quality of Service (QoS) so as to offer the multimedia services.

To support a seamless service, the wireless communication system supports handover of a Mobile Station (MS). For instance, when the MS migrates from its serving Base Station (BS) to a target BS, the wireless communication system supports the handover which connects a call of the MS from the serving BS to the target BS to provide the seamless service to the MS. To connect the call to the target BS, the MS performs a ranging procedure with the target BS.

As discussed above, when the MS hands over to the target BS, the MS is serviced by the target BS only after it accesses the target BS through the ranging procedure with the target BS. In doing so however, the handover of the MS can be delayed due to the ranging procedure with the target BS.

Accordingly, there is a need for an improved apparatus and a method for reducing handover delay in a wireless communication system.

SUMMARY OF THE INVENTION

An aspect of the present invention is to address at least the above-mentioned problems and/or disadvantages and to provide at least the advantages described below. Accordingly, an aspect of the present invention is to provide an apparatus and a method for reducing handover delay in a wireless communication system.

Another aspect of the present invention is to provide an apparatus and a method for reducing delay in handover by requesting necessary bandwidth information to a target BS before an MS re-enters a network of the target BS in a wireless communication system.

Yet another aspect of the present invention is to provide an apparatus and a method for transferring bandwidth information requested by an MS to a target BS when the MS serviced by a BS hands over to the target BS in a wireless communication system.

Still another aspect of the present invention is to provide an apparatus and a method for transferring information of a

resource to be allocated to an MS to a target BS when the MS serviced by a BS hands over to the target BS in a wireless communication system.

A further aspect of the present invention is to provide an apparatus and a method for a BS to accurately confirm handover of an MS using a unique code assigned to the MS which requests the handover in a wireless communication system.

In accordance with an aspect of the present invention, a handover method of a Mobile Station (MS) in a wireless communication system is provided. The method includes, when handing over to another Base Station (BS) while being serviced by a serving BS, determining if there exists data to transmit in an uplink, and when the data to transmit in the uplink exists, requesting a bandwidth to the serving BS before commencing a network re-entry to a target BS for the handover.

In accordance with another aspect of the present invention, a method of a BS for supporting a handover of an MS in a wireless communication system is provided. The method includes determining whether to support handover of an MS when receiving a handover request of the MS from a neighboring BS, informing the neighboring BS of the handover supportability of the MS, allocating a resource to the MS by considering bandwidth request information of the MS when receiving handover indication information comprising bandwidth request information of the MS from the neighboring BS, and transmitting and receiving data to and from the MS using the resource allocated to the MS.

In accordance with another aspect of the present invention, a method of a Base Station (BS) for controlling a handover of a Mobile Station (MS) in a wireless communication system is provided. The method comprises determining at least one neighboring BS capable of supporting handover of an MS when the MS desires handover to another BS and transmitting information of a scheduled resource not allocated to the MS to a target BS.

In accordance with yet another aspect of the present invention, a handover apparatus of an MS in a wireless communication system is provided. The apparatus includes a receiver for receiving a signal, a transmitter for sending a signal, and a controller for, when handing over to another Base Station (BS) while being serviced by a serving BS and there exists data to transmit over an uplink, controlling to request a bandwidth to the serving BS before commencing a network re-entry to a target BS for the handover.

In accordance with still another aspect of the present invention, an apparatus of a BS for controlling a handover of an MS in a wireless communication system is provided. The apparatus includes a receiver for receiving a signal, a transmitter for sending a signal, a wireline interface for transmitting and receiving signals to and from at least one neighboring BS over a wired network, and a controller for, when receiving handover indication information comprising bandwidth request information of the MS through the wireline interface, allocating a resource to the MS by taking into account the bandwidth request information of the MS and controlling to transmit and receive data to and from the MS using the allocated resource.

Other aspects, advantages, and salient features of the invention will become apparent to those skilled in the art from the following detailed description, which, taken in conjunction with the annexed drawings, discloses exemplary embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features and advantages of certain exemplary embodiments of the present invention will be more apparent from the following description taken in conjunction with the accompanying drawings, in which:

FIG. **1** illustrates a handover procedure in a wireless communication system according to an exemplary embodiment of the present invention;

FIG. **2** illustrates a handover procedure in a wireless communication system according to an exemplary embodiment of the present invention;

FIG. **3** illustrates a structure of a Mobile Station (MS) for handover according to an exemplary embodiment of the present invention; and

FIG. **4** illustrates a structure of a Base Station (BS) for handover according to an exemplary embodiment of the present invention.

Throughout the drawings, like reference numerals will be understood to refer to like parts, components and structures.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

The following description with reference to the accompanying drawings is provided to assist in a comprehensive understanding of exemplary embodiments of the present invention as defined by the claims and their equivalents. It includes various specific details to assist in that understanding but these are to be regarded as merely exemplary. Accordingly, those of ordinary skill in the art will recognize that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the invention. Also, descriptions of well-known functions and constructions are omitted for clarity and conciseness.

The terms and words used in the following description and claims are not limited to the bibliographical meanings, but, are merely used by the inventor to enable a clear and consistent understanding of the invention. Accordingly, it should be apparent to those skilled in the art that the following description of exemplary embodiments of the present invention are provided for illustration purpose only and not for the purpose of limiting the invention as defined by the appended claims and their equivalents.

It is to be understood that the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to "a component surface" includes reference to one or more of such surfaces.

By the term "substantially" it is meant that the recited characteristic, parameter, or value need not be achieved exactly, but that deviations or variations, including for example, tolerances, measurement error, measurement accuracy limitations and other factors known to skill in the art, may occur in amounts that do not preclude the effect the characteristic was intended to provide.

Exemplary embodiments of the present invention provide a technique for reducing handover delay in a wireless communication system.

Hereinafter, a Base Station (BS) servicing a Mobile Station (MS) prior to its handover is referred to as a serving BS and the BS to which the MS newly accesses through the handover is referred to as a target BS. When the BS and the MS transmit and receive signals with each other over radio resources, the BSs transmit and receive signals over a backbone.

When there exists data to transmit in the uplink prior to a network re-entry to the target BS in the wireless communication system, the MS requests a bandwidth to the target BS via the serving BS to reduce the handover delay. For example, at the point of the handover indication to the serving BS, the MS can request the bandwidth to the serving BS as shown in FIG. **1**.

FIG. **1** illustrates a handover procedure in a wireless communication system according to an exemplary embodiment of the present invention.

Referring to FIG. **1**, when an MS **101** serviced by serving BS **103** desires handover, the MS **101** sends a HandOver (HO)-REQuest (REQ) message to the serving BS **103** in step **111**.

Upon receiving the HO-REQ message from the MS **101**, the serving BS **103** informs neighboring BSs of the handover request of the MS **101** in step **113**. That is, the serving BS **103** sends the MS HO-REQ message of the MS **101** to the neighboring BSs to determine which neighboring BSs are capable of supporting handover of the MS **101**. Herein, the neighboring BSs include a target BS **105**.

After receiving the HO-REQ message of the MS **101**, the neighboring BSs determine whether they can support handover of the MS **101**. That is, when the MS **101** desires handover to a neighboring BS, each neighboring BS determines whether it can service the MS **101**. The neighboring BSs capable of supporting the handover of the MS **101** assign an MS IDentifier (ID) to the MS **101**.

To inform the serving BS **103** of their ability to support handover of the MS **101**, the neighboring BSs each send an MS HO-ReSPonse (RSP) message regarding the MS **101** to the serving BS **103** in step **115**. That is, the neighboring BSs capable of supporting handover of the MS **101** include the MS ID assigned to the MS **101** in the HO-RSP message and send the HO-RSP message.

The serving BS **103** confirms the information of the neighboring BSs that support handover of the MS **101** from the HO-RSP message. Next, the serving BS **103** generates a HO-RSP message including the information of the neighboring BSs that support handover of the MS **101** and sends the HO-RSP message to the MS **101** in step **117**. Herein, the HO-RSP message includes the information of the candidate BSs to which the MS **101** can hand over, the MS ID of the MS **101** assigned by the candidate BSs, and encryption key (TEK) information for communication with the candidate BSs.

The MS **101** selects the target BS **105** for handover from among the candidate BSs confirmed from the HO-RSP message. In step **119**, the MS **101** indicates the handover to the serving BS **103**. In doing so, when there exists data to transmit in an uplink, the MS **101** sends BandWidth-REQuest (BW-REQ) information to the serving BS **103**. For example, the MS **101** may send an HO-INDication (IND) message, indicative of the handover to the target BS, to the serving BS **103** and include therein the BW-REQ information. In an alternative embodiment, the MS **101** may constitute the BW-REQ message separately from the HO-IND message and then send the BW-REQ message to the serving BS **103**.

The serving BS **103** confirms the target BS **105** selected by the MS **101** based on the HO-IND message. In an exemplary implementation, the serving BS **103** may confirm the BW-REQ information of the MS **101**. For example, the serving BS **103** may confirm the BW-REQ information of the MS **101** in the HO-IND message. Alternatively, the serving BS **103** may confirm the BW-REQ information of the MS **101** based on the BW-REQ message received from the MS **101**.

Next, the serving BS **103** indicates handover of the MS **101** to the target BS **105** in step **121**. The serving BS **103** also sends the BW-REQ information of the MS **101** to the target BS **105**. For example, the serving BS **103** may send the HO-IND message of the MS **101** and include the BW-REQ information of the MS **101** therein. Alternatively, the serving

BS **103** may generate a BW-REQ message separately from the HO-IND message and send the BW-REQ message to the target BS **105**.

Regarding the sending of the BW-REQ information of the MS **101** to the target BS **105**, in an exemplary implementation, the serving BS **103** transmits information of scheduled resources not allocated to the MS **101** to the target BS **105**. For instance, the serving BS **103** sends the BW-REQ information requested by the MS **101** in step **119**, to the target BS **105**. Alternatively, the serving BS **103** may send the BW-REQ information requested by the MS **101** in step **119**, and the information of resources not allocated to the MS **101**, to the target BS **105**.

The target BS **105** confirms the handover of the MS **101** based on the HO-IND message received from the serving BS **103**. Also, the target BS **105** confirms the BW-REQ information requested by the MS **101**. Thus, the target BS **105** allocates resources to the MS **101** by taking into account the BW-REQ information of the MS **101** received from the serving BS **103** in step **123**. In so doing, the target BS **105** sends a resource allocation message to the MS **101** using the MS ID assigned to the MS **101** in step **115**. Herein, the resource allocation message includes a DownLink (DL) MAP and an UpLink (UL) MAP.

In step **125**, the target BS **105** transmits DL data to the MS **101** using the DL resource allocated to the MS **101**. Using the encryption key of the target BS **105** as confirmed from the HO-RSP message received from the serving BS **103** in step **117**, the MS **101** can communicate with the target BS **105**.

The MS **101** transmits UL data using the UL resources allocated from the target BS **105** in step **127**.

The MS **101** performs a ranging procedure with the target BS **105** to access the target BS **105** in steps **129** and **131**. For example, the MS **101** sends a ranging code to the target BS **105** over a certain channel. Upon receiving the ranging code, the target BS **105** allocates resources so that the MS **101** can send a RaNGing (RNG)-REQ message. Using the resource allocated from the target BS **105**, the MS **101** sends the RNG-REQ message to the target BS **105** in step **129**. The target BS **105** sends a RNG-RSP message to the MS **101** in reply to the RNG-REQ message received from the MS **101** in step **131**.

In various exemplary embodiments, the data transmission and the reception between the MS **101** and the target BS **105** of steps **125** and **127** and the ranging procedure between the MS **101** and the target BS **105** of steps **129** and **131** can be carried out in order or in parallel. Furthermore, the ranging procedure of steps **129** and **131** may precede the data transmission and reception of steps **125** and **127**.

In an exemplary embodiment, the MS **101** provides a bandwidth request to the serving BS **103** at the point of the handover indication to the serving BS **103**. However, when there exists data to transmit in the uplink at any time before the network re-entry to the target BS **105**, the MS **101** can provide the bandwidth request to the serving BS **103**. Alternatively, the MS **101** may periodically transmit the BW-REQ information to the serving BS **103** until the network re-entry to the target BS **105**.

In FIG. **1**, it is assumed that the handover is initiated by the request of the MS **101** and the MS **101** determines the target BS **105**. In another exemplary implementation, the serving BS **103** may request the handover or the serving BS **103** may determine the target BS **105**. In this case, the MS **101** may selectively send the HO-IND message to the serving BS **103**. That is, the MS **101** may or may not send the HO-IND message to the serving BS **103**.

To more clearly confirm the handover of the MS at the target BS, the wireless communication system may allocate a dedication code to the MS which requests the handover as illustrated in FIG. **2**.

FIG. **2** illustrates a handover procedure in a wireless communication system according to an exemplary embodiment of the present invention.

Referring to FIG. **2**, when an MS **201** serviced by a serving BS **203** desires handover, the MS **201** sends an HO-REQ message to the serving BS **203** in step **211**.

Upon receiving the HO-REQ message from the MS **201**, the serving BS **203** informs neighboring BSs of the handover request of the MS **201** in step **213**. That is, the serving BS **203** sends the MS HO-REQ message of the MS **201** to neighboring BSs to determine which neighboring BSs are capable of supporting handover of the MS **201**. Herein, the neighboring BSs include a target BS **205**.

After receiving the HO-REQ message of the MS **201**, the neighboring BSs determine whether they can support handover of the MS **201**. That is, when the MS **201** desires handover to a neighboring BS, each neighboring BS determines whether it can service the MS **201**. The neighboring BSs capable of supporting the handover of the MS **201** assign an MS ID and a dedication code for confirming the handover, to the MS **201**.

To inform of the handover supportability of the MS **201**, the neighboring BSs each sends an MS HO-RSP message regarding the MS **201** to the serving BS **203** in step **215**. That is, the neighboring BSs capable of supporting handover of the MS **201** include the MS ID assigned to the MS **101** and the dedication code, in the HO-RSP message and send the HO-RSP message.

The serving BS **203** confirms the information of the neighboring BSs that support handover of the MS **201** from the HO-RSP message. In step **217**, the serving BS **203** generates a HO-RSP message including the information of the neighboring BSs that support handover of the MS **201** and sends the HO-RSP message to the MS **201**. Herein, the HO-RSP message includes the information of the candidate BSs to which the MS **201** can hand over, the MS ID of the MS **201** as assigned by the candidate BSs, encryption key (TEK) information for communication with the candidate BSs, and the dedication code allocated to the MS **201** by the candidate BSs.

The MS **201** selects the target BS **205** for handover from among the candidate BSs confirmed from the HO-RSP message. In step **219**, the MS **201** indicates handover to the serving BS **203**. In doing so, when there exists data to transmit in an uplink, the MS **201** sends BW-REQ information to the serving BS **203**. For example, the MS **201** may include the BW-REQ information in the HO-IND message indicative of handover to the target BS and send the HO-IND message to the serving BS **203**. In an alternative embodiment, the MS **201** may constitute the BW-REQ message separately from the HO-IND message and then send the BW-REQ message to the serving BS **203**.

After sending the HO-IND message to the serving BS **203**, the MS **201** sends the dedication code assigned from the target BS **205**, to the target BS **205** in step **223**. Namely, the MS **201** sends a dedication code ranging message to the target BS **205**.

The serving BS **203** confirms the target BS **205** selected by the MS **201** based on the HO-IND message. In an exemplary embodiment, the serving BS **203** may also confirm the BW-REQ information of the MS **201**. For example, the serving BS **203** may confirm the BW-REQ information of the MS **201** in the HO-IND message. Alternatively, the serving BS **203** may confirm the BW-REQ information of the MS **201** based on the BW-REQ message received from the MS **201**.

In step **221**, the serving BS **203** indicates handover of the MS **201** to the target BS **205**. In an exemplary implementation, the serving BS **203** forwards the BW-REQ information of the MS **201** to the target BS **205**. For example, the serving BS **203** may send the HO-IND message of the MS **201** to the target BS **205** and include the BW-REQ information of the MS **201** therein. Alternatively, the serving BS **203** may generate a BW-REQ message separately from the HO-IND message and send the BW-REQ message to the target BS **205**.

Regarding the sending of the BW-REQ information of the MS **201** to the target BS **205**, in an exemplary implementation, the serving BS **203** transmits information of scheduled resources not allocated to the MS **201**, to the target BS **205**. For instance, the serving BS **203** sends the BW-REQ message requested by the MS **201** in step **219**, to the target BS **205**. Alternatively, the serving BS **203** may send the BW-REQ message requested by the MS **201** in step **219** and the information of the resource not allocated to the MS **201**, to the target BS **205**.

The target BS **205** confirms the handover of the MS **201** based on the HO-IND message received from the serving BS **203**. Also, the target BS **205** confirms the BW-REQ information requested by the MS **201**.

When receiving the dedication code information from the MS **201**, the target BS **205** may be assured of handover of the MS **201** to itself. Hence, the target BS **205** allocates the resource to the MS **201** by taking into account the BW-REQ information of the MS **201** received from the serving BS **203** in step **225**. In so doing, the target BS **205** sends a resource allocation message to the MS **201** using the MS ID assigned to the MS **201** in step **215**. Herein, the resource allocation message includes a DL MAP and a UL MAP.

Based on the dedication code received from the MS **201**, the target BS **205** may recognize that it will receive the RNG-REQ message sent from the MS **201**. In this situation, the target BS **205** can send the resource allocation information to the MS **201** by including the information of the resource through which the MS **201** can send the RNG-REQ message. Alternatively, the target BS **205** may add information of the resource through which the MS **201** can send the RNG-REQ message, into a separate resource allocation message.

After sending the resource allocation message to the MS **201**, the target BS **205** transmits DL data to the MS **201** using the DL resource allocated to the MS **201** in step **227**. Using the encryption key of the target BS **205** as confirmed from the HO-RSP message received from the serving BS **203** in step **217**, the MS **201** can communicate with the target BS **205**.

The MS **201** transmits UL data using the UL resource allocated from the target BS **205** in step **229**.

The MS **201** performs the ranging procedure with the target BS **205** to access the target BS **205** in steps **231** and **233**. For example, the MS **201** confirms the resource for the RNG-REQ message from the resource allocation message received from the target BS **205**. Using the resource allocated from the target BS **205**, the MS **201** sends the RNG-REQ message to the target BS **205** in step **231**. The target BS **205** sends a RNG-RSP message to the MS **201** in reply to the RNG-REQ message received from the MS **201** in step **233**

The data transmission and the reception between the MS **201** and the target BS **205** of steps **227** and **229** and the ranging procedure between the MS **201** and the target BS **205** of steps **231** and **233** can be carried out in order or in parallel. Furthermore, the ranging procedure of steps **231** and **233** may precede the data transmission and reception of steps **227** and **229**.

In an exemplary embodiment, the MS **201** provides a bandwidth request to the serving BS **203** at the point of the handover indication to the serving BS **203**. Alternatively, the MS **201** may periodically transmit the BW-REQ information to the serving BS **203** until the network re-entry to the target BS **205**.

In FIG. **2**, it is assumed that the handover is initiated at the request of the MS **201** and the MS **201** determines the target BS **205**. However, the serving BS **203** may request the handover or the serving BS **203** may determine the target BS **205**. In this case, the MS **201** may selectively send the HO-IND message to the serving BS **203**. That is, the MS **201** may or may not send the HO-IND message to the serving BS **203**.

Now, an exemplary structure of an MS for handing over to a target BS is explained.

FIG. **3** is a block diagram of an MS for handover according to an exemplary embodiment of the present invention.

Referring to FIG. **3**, the MS includes a duplexer **300**, a receiver **310**, a controller **320**, and a transmitter **330**.

According to the duplexing, the duplexer **300** transfers the transmit signal output from the transmitter **330** over an antenna and provides a signal received over the antenna to the receiver **310**.

The receiver **310** includes a Radio Frequency (RF) processor **311**, an Analog/Digital Converter (ADC) **313**, an Orthogonal Frequency Division Multiplexing (OFDM) demodulator **315**, a decoder **317**, and a message processor **319**.

The RF processor **311** converts an RF signal output from the duplexer **300** into a baseband analog signal. The ADC **313** converts the analog signal output from the RF processor **311** into digital sample data. The OFDM demodulator **315** converts the time-domain sample data output from the ADC **313** into frequency-domain data using a Fast Fourier Transform (FFT) process.

The decoder **317** demodulates and decodes the signal output from the OFDM demodulator **315** at a corresponding modulation level. Herein, the modulation level indicates a Modulation and Coding Scheme (MCS) level.

The message processor **319** detects the control signal from the signal output from the decoder **317** and provides the detected control signal to the controller **320**. For instance, the message processor **319** detects the HO-RSP message received from the serving BS and the resource allocation message and provides the detected messages to the controller **320**.

The controller **320** controls the overall operation and the handover of the MS.

More particularly, in an exemplary implementation of controlling the handover, the controller **320** considers the signal intensity.

The controller **320** selects the target BS for the handover from the candidate BSs confirmed based on the HO-RSP message provided from the message processor **319**.

When there exists data to transmit in the uplink prior to the network re-entry to the target BS, the controller **320** controls to send the BW-REQ information to the serving BS. For instance, the controller **320** controls to send the BW-REQ information when the handover is indicated to the serving BS. Alternatively, the controller **320** controls to periodically transmit the BW-REQ information before the network re-entry to the target BS. Hence, the MS can communicate with the target BS before the ranging with the target BS.

A storage **321** stores the MS ID assigned from the target BS for the handover, and the encryption key information under the control of the controller **320**.

The transmitter **330** includes a message generator **331**, an encoder **333**, an OFDM modulator **335**, a Digital/Analog Converter (DAC) **337**, and an RF processor **339**.

The message generator **331** generates the control message for the handover under the control of the controller **320**. For example, when the controller **320** determines to hand over, the message generator **331** generates the HO-REQ message to request the handover to the serving BS.

When the controller **320** determines the target BS for the handover, the message generator **331** generates the HO-IND message to indicate the handover to the target BS. In so doing, the message generator **331** generates the BW-REQ message to request the necessary band. For example, the message generator **331** generates the HO-IND message including the BW-REQ information. Alternatively, the message generator **331** may generate the BW-REQ message separately from the HO-IND message.

The encoder **333** encodes and modulates the transmit signal or the message output from the message generator **331** at the corresponding modulation level.

The OFDM modulator **335** converts the frequency-domain data output from the encoder **333** into time-domain sample data (i.e., OFDM symbols) through an Inverse FFT (IFFT) process.

The DAC **337** converts the sample data output from the OFDM modulator **335** into an analog signal. The RF processor **339** converts the baseband analog signal output from the DAC **337** into an RF signal.

In an exemplary embodiment, the MS receives the MS ID of the candidate BSs and the encryption key information from the serving BS. Correspondingly, the controller **320** controls to store the MS ID assigned from the target BS and the encryption key information in the storage **321**.

In another exemplary embodiment, the MS receives the MS ID of the candidate BSs, the encryption key, and the dedication code information from the serving BS. In a certain time after the handover is indicated to the serving BS, the controller **320** controls to transmit the dedication code information to the target BS.

In an exemplary embodiment, the controller **320** determines whether to request the handover and selects the target BS. In an alternative exemplary implementation, when the serving BS requests the handover or the serving BS selects the target BS, the controller **320** commences the handover according to the request of the serving BS. Also, the controller **320** confirms the target BS information determined by the serving BS. The controller **320** controls the message generator **331** to selectively transmit the HO-IND message to the serving BS.

The following explanations describe a structure of an exemplary BS for controlling handover of an MS.

FIG. **4** is a block diagram of a BS for handover according to an exemplary embodiment of the present invention.

Referring to FIG. **4**, the BS includes a duplexer **400**, a receiver **410**, a controller **420**, and a transmitter **430**.

According to the duplexing, the duplexer **400** transfers a transmit signal output from the transmitter **430** over an antenna and provides a signal received over the antenna to the receiver **410**.

The receiver **410** includes an RF processor **411**, an ADC **413**, an OFDM demodulator **415**, a decoder **417**, and a message processor **419**.

The RF processor **411** converts an RF signal output from the duplexer **400** into a baseband analog signal. The ADC **413** converts the analog signal output from the RF processor **411** into digital sample data. The OFDM demodulator **415** converts the time-domain sample data output from the ADC **413** into frequency-domain data using the FFT process.

The decoder **417** demodulates and decodes the signal output from the OFDM demodulator **415** at the corresponding modulation level.

The message processor **419** detects the control signal from the signal output from the decoder **417** and provides the detected control signal to the controller **420**. For instance, the message processor **419** detects the HO-REQ message and the HO-IND message received from the serviced MS and provides the detected messages to the controller **420**.

The controller **420** controls overall operations of the BS and the handover of the MS traveling in its service coverage area. For example, when the BS is the serving BS, the controller **420** controls to request the handover of the MS to the neighboring BSs to search for candidate BSs capable of supporting handover of the MS. The controller **420** controls to send the HO-REQ message of the MS to the neighboring BSs over a wired network connected through a wireline interface. Herein, the wired network includes a backbone.

The controller **420** indicates the handover of the MS to the target BS confirmed from the HO-IND message provided from the message processor **419**. For example, the BS includes a wireline interface for communicating with the neighboring BSs over the backbone. Hence, the controller **420** indicates the handover of the MS to the target BS through the wireline interface.

To indicate the handover of the MS to the target BS, the controller **420** controls to send the BW-REQ information of the MS handing over to the target BS, to the target BS. In so doing, the controller **420** controls to send information of resources not allocated to the MS through the scheduling, to the target BS. For example, the controller **420** controls to transmit the BW-REQ information requested by the MS to the target BS. Alternatively, the controller **420** may control to send the BW-REQ information requested by the MS and the information of the resource not allocated to the MS, to the target BS.

When the BS is the target BS, the controller **420** examines whether it is able to support handover of the MS requested by the neighboring BS through the wireline interface. When it can support handover of the MS, the controller **420** controls an MS ID allocator **421** to assign the MS ID to the MS.

In receiving the handover indication of the MS from the neighboring BS via the wireline interface, the controller **420** can confirm the resources required by the MS. Before the ranging procedure with the MS, the controller **420** allocates the resources to the MS by taking into account the required resource information of the MS.

The MS ID allocator **421** assigns the MS ID to the MS that desires handover, under the control of the controller **420**.

The transmitter **430** includes a message generator **431**, an encoder **433**, an OFDM modulator **435**, a DAC **437**, and an RF processor **439**.

The message generator **431** generates the control message for the handover under the control of the controller **420**. For example, the message generator **431** generates the HO-RSP message including the information of the neighboring BSs capable of supporting handover of the MS. In an exemplary implementation, the message generator **431** constitutes the HO-RSP message to include the MS ID assigned by the neighbor BSs and the encryption key information.

Also, the message generator **431** generates the resource allocation information including the information of the resources allocated to the MS.

The encoder **433** encodes and modulates the transmit signal or the message output from the message generator **431** at the corresponding modulation level.

The OFDM modulator **435** converts the frequency-domain data output from the encoder **433** to time-domain sample data (i.e., OFDM symbols) through the IFFT process.

The DAC **437** converts the sample data output from the OFDM modulator **435** into an analog signal. The RF processor **439** converts the baseband analog signal output from the DAC **437** into an RF signal.

In an exemplary embodiment, in the case of the serving BS, the BS commences the handover as requested by the MS and confirms the target BS selected by the MS.

In an alternative embodiment, the BS may request the handover or select the target BS. In this situation, the controller **420** determines whether to commence the handover of the MS, and selects the target BS of the MS.

In a case of the target BS, the BS assigns the MS ID to the MS that desires handover.

Alternatively, the BS may assign the MS ID and the dedication code to the MS capable of supporting the handover. In this case, the MS ID allocator **421** allocates the MS ID and the dedication code to the MS under the control of the controller **420**. After the controller **420** receives the handover indication of the MS from the neighboring BS, the handover of the MS is assured only by receiving the dedication code information of the MS from the message processor **419**. Accordingly, after receiving the dedication code from the MS, the controller **420** allocates the resource to the MS by taking into consideration the required resource information of the MS.

The controller **420** may recognize that the MS will send the RNG-REQ message to the target BS, based on the dedication code received from the MS. Hence, the controller **420** allocates the resource by which the MS can send the RNG-REQ message.

As set forth above, the MS requests the required bandwidth information to the target BS via the serving BS before its network re-entry to the target BS to which the MS hands over in the wireless communication system. Therefore, the handover delay can be reduced, and the BS can confirm the handover of the MS by assigning the unique code to the MS which requests the handover.

While the invention has been shown and described with reference to certain exemplary embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims and their equivalents.

What is claimed is:

1. A method for operating a mobile station (MS) in a wireless communication system, the method comprising:
- receiving, from a serving base station (BS), a message comprising a dedicated code allocated by a target BS;
- transmitting, to the serving BS, a request for bandwidth for residual data to transmit from the MS before performing a network re-entry procedure with the target BS for the handover;
- transmitting, to the target BS, the dedicated code for the network re-entry;
- receiving, from the target BS, at the MS, resource allocation information on a resource allocated for the residual data that the serving BS has not allocated; and
- transmitting, to the target BS, the residual data from the MS using the resource allocated by the target BS.

2. The method of claim **1**, wherein the transmitting of the request for bandwidth comprises:
- periodically transmitting bandwidth request information from the MS to the serving BS before the performing of the network re-entry procedure with the target BS.

3. The method of claim **1**, wherein the transmitting of the request for bandwidth comprises:
- transmitting the request for bandwidth using a message indicating the handover of the MS to the target BS.

4. A method for operating a base station (BS) in a wireless communication system, the method comprising:
- receiving a handover request of a mobile station (MS) from a neighboring BS;
- transmitting, to the neighboring BS, a message comprising a dedicated code allocated to the MS;
- receiving, from the MS, the dedicated code for the network re-entry;
- receiving, from the neighboring BS, a request for bandwidth for residual data to be transmitted by the MS;
- allocating a resource to the MS based on the request; and
- receiving the residual data from the MS using the resource allocated to the MS.

5. The method of claim **4**, further comprising:
- assigning an IDentifier (ID) to the MS if the handover of the MS is supported,
- wherein the message comprises the ID.

6. A method for operating a serving base station (BS) in a wireless communication system, the method comprising:
- receiving, from a target BS other than the serving BS, a first message comprising a dedicated code allocated by the target BS;
- transmitting, to a mobile station (MS), a second message comprising the dedicated code;
- receiving, from the MS, a request for bandwidth for residual data to be transmitted by the MS; and
- transmitting, to the target BS, the request for bandwidth.

7. The method of claim **6**, further comprising:
- determining the target BS to which the MS is to hand over, among at least one neighboring BS capable of supporting the handover of the MS; and
- transmitting target BS information to the MS.

8. The method of claim **6**, further comprising:
- transmitting information of at least one neighboring BS capable of supporting the handover of the MS, to the MS; and
- identifying the target BS to which the MS is to hand over, if the MS indicates the handover.

9. An apparatus for a mobile station (MS) in a wireless communication system, the apparatus comprising:
- a receiver configured to receive, from a serving base station (BS), a message comprising a dedicated code allocated by a target BS; and
- a transmitter configured to transmit, to the serving BS, a request for bandwidth for residual data to transmit from the MS before performing a network re-entry procedure with the target BS for the handover,
- wherein the transmitter is further configured to transmit, to the target BS, the dedicated code for the network re-entry,
- wherein the receiver is further configured to receive, from the target BS, at the MS, resource allocation information on a resource allocated for the residual data that the serving BS has not allocated, and
- wherein the transmitter is further configured to transmit, to the target BS, the residual data from the MS using the resource allocated by the target BS.

10. The apparatus of claim **9**, wherein the transmitter is further configured to periodically transmit bandwidth request information to the serving BS before the network re-entry procedure with the target BS is performed.

11. The apparatus of claim **9**, wherein the transmitter is further configured to transmit the request for bandwidth using a message indicating the handover of the MS to the target BS.

12. An apparatus for a base station (BS) in a wireless communication system, the apparatus comprising:

a controller configured to receive a handover request of a mobile station (MS) from a neighboring BS, to transmit, to the neighboring BS, a message comprising a dedicated code allocated to the MS; and

a receiver configured to receive, from the MS, the dedicated code for the network re-entry,

wherein the controller is further configured to receive, from the neighboring BS, a request for bandwidth for residual data to be transmitted by the MS, and, to allocate a resource to the MS based on the request, and

wherein the receiver is further configured to receive the residual data from the MS using the resource allocated to the MS.

13. The apparatus of claim **12**, wherein, if the handover of the MS is requested from the neighboring BS, the controller is further configured to determines whether to support the handover of the MS and controls to inform the neighboring BS of a handover supportability.

14. The apparatus of claim **13**, further comprising:

an allocator for allocating an identifier (ID) to the MS, wherein the message comprises.

15. An apparatus for a serving base station (BS) for controlling a handover of a mobile station (MS) in a wireless communication system, the method comprising:

a controller configured to receive, from a target BS other than the serving BS, a first message comprising a dedicated code allocated by the target BS during network re-entry;

a transmitter configured to transmit, to the MS, a second message comprising the dedicated code;

and a receiver configured to receive, from the MS, a request for bandwidth for residual data to be transmitted by the MS,

wherein the controller is further configured to transmit, to the target BS, the request for bandwidth.

16. The apparatus of claim **15**, wherein the controller is further configured to determine the target BS to which the MS is to hand over, among at least one neighboring BS capable of supporting the handover of the MS, and

wherein the transmitter is further configured to transmit target BS information to the MS.

17. The apparatus of claim **15**, wherein the transmitter is further configured to transmit information of at least one neighboring BS capable of supporting the handover of the MS, to the MS, and

wherein the controller is further configured to identify the target BS to which the MS is to hand over, if the MS indicates the handover.

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